CLAIMS

1. A method for creating a control range suitable for detecting cognitive processing of at least one test subject using a standardised task, the method comprising:

- measurement of time to complete the standardised task in a group of control subjects; and
- measurement of temporal eyeblink occurrence during performance of the task by the control subjects; and
- calculation of a control range for the control subjects, the control range being calculated from at least the temporal eyeblink occurrence during a common phase within the standardised task for the control subjects;

wherein deviation from the control range indicates the test subject has altered cognitive processing relative to the control subjects.

2. The method according to claim 1, wherein the temporal eyeblink occurrence is used to derive the gap or time elapsed between blinks over a plurality of adjacent blink events.

3. The method according to claim 1 or claim 2, wherein the standardised task is a structured task, where the common phase is selected from:

- a first orientation phase, occurring at commencement of the task;
- a second or intermediate phase showing the test subject's task progress; and
- a common task completion period (CTCP) of the task.

4. The method according to claim 3, wherein the structured task is chosen to emphasise the control subject's mental processing during the orientation phase and/or intermediate phase of the task by incorporation of the orientation phase and/or intermediate phase into later phases of the task.

5. The method according to claim 3 or claim 4, wherein the common phase of the standardised task is the completion phase of the task.

6. The method according to any one of claims 1 to 5, wherein measurement of at least one of eyeblink characteristic of eyeblink power B is also performed, the eyeblink characteristic being selected from eyeblink duration and eyeblink amplitude, the eyeblink characteristics occurring during performance of the standardised or structured task.

7. The method according to claim 6, wherein B is a mathematical derivative of eyeblink amplitude and eyeblink duration.

8. The method according to claim 6, wherein B is a mathematical derivative of eyeblink duration, eyeblink amplitude and temporal gap between eyeblink occurrence.

9. The method according to claim 2, wherein the common phase of control subject's performance in the common phase of the task is analysed by plotting or tracking quantitative gap time elapsed between the plurality of blink events against time of the task.

10. The method according to claim 9, wherein measurement of at least one eyeblink characteristic of eyeblink power B is also plotted or tracked for each blink against time of at least the common task, wherein B is selected from eyeblink duration, eyeblink amplitude, temporal gap between eyeblink occurrence or any derivative thereof.

11. The method according to claim 10, wherein individual blinks are smoothed and weighted by clustering into peaks occurring over the common phase within the task.

12. The method according to claim 11, wherein cognitive processing of a first control subject is compared to the cognitive processing of a second control subject, both subjects having a similar task completion time, by comparison of clusters of blinks occurring during the standardised task, to create a control range for clusters of blinks during a common phase of the task for a particular time taken to complete the task.

13. The method according to claim 11 or claim 12, wherein a smoothing function F is used to compare blink clusters on a two-dimensional scale of blink density D against time for

the common phase of the task, and wherein number of blinks per cluster is estimated by a peak area above an opening function of a background bliuk rate (BB), with a converse measure being a proportion of time that blink density does not exceed a baseline of the background blink rate of the blink density.

14. The method according to claim 13, wherein individual blinks are weighted by assigning a weighting using variables selected from unit weighting, absolute amplitude value (a), absolute duration value (d), absolute gap value (G) or a weighting derivative thereof.

15. The method according to claim 14, wherein the weighting derivative is a x d.

16. The method according to claim 14, wherein the weighting derivative is a x d x G.

17. The method according to claim 14, wherein the weighting derivative is a x d / G

18. The method according to claim 3, which further includes interpretation of the control subjects' performances in the structured task using additional parameters for each control subject, the additional parameters including at least one intensive parameter calculated from the common phase of the task, and at least one extensive parameter calculated from blink patterns over the entire task, the intensive parameter being selected from the group comprising:

- percent of blinking time in the CTCP, when blink density is above a baseline blink density (I1);
- mean cluster size per cluster (integral of blink density divided by number of peaks in last CTCP, representative of blinks clustered at each concentration release, whereby blink clusters are determined by measuring the area of each cluster peak above the local baseline) (I2);
- average baseline blink density in last CTCP (derived from the opening function by calculation of the incidence of minimum followed by a maximum in the relative density function within a threshold of 15 seconds or 10%-20% of the CTCP) (I3); and

- average blink rate for the Task (calculated by total number of blinks over the Task on total time taken for the entire Task) (I4),

wherein I1 - I3 are derived using a smoothed blink density function F for each blink, and wherein the extensive parameter is selected from the group comprising:

- total duration of Task (E1 or T);
- total number of blinks (E2 or N);
- number of clusters during entire Task time (peaks in blink density) (E3); and
- indirect measure of number of clusters/attempts at stages in task (E4), using a formula of attempts (A) = T^2/sum(gap^2);

wherein variation in one or more intensive and one or more extensive parameters calculated for the control subjects provides data for the control range for the one or more intensive or extensive parameters.

19. The method according to claim 18, wherein the smoothing function F is a normal Gaussian function.

20. A method according to any one of claims 1 to 19, wherein the control group consists of subjects with normal cognitive function.

21. A method according to any of claims 1 to 19, wherein the control group consists of subjects with compromised cognitive function.

22. A method according to any one of claims 1 to 19, wherein the control group consists of subjects with enhanced cognitive function.

23. A method according to claim 21, wherein the compromised cognitive function is associated with a disorder selected from the group comprising ADD, ADHD, dyslexia, dementia, schizophrenia, depression, learning disorders, sleep disorder, stress disorder, personality disorders, borderline personality disorders, or cognitive function impaired or enhanced by alcohol or drug ingestion.

24. A method for detecting cognitive processing of at least one test subject using at least one standardised task, the method comprising:

- measurement of the subject's time to complete the standardised task; and
- measurement of temporal eyeblink occurrence; and
- comparison of the temporal eyeblink occurrence or a value derived therefrom, during a common phase within the standardised task, with a control range, the control range calculated from at least the temporal eyeblink occurrence during the common phase within the standardised task for a control group;

wherein deviation from the control range indicates the test subject has altered cognitive processing relative to the control group.

25. The method according to claim 24, wherein the control range is calculated according to any one of the methods of claims 1 to 23.

26. The method according to claim 25, wherein the test subject's cognitive processing is compared with a control range of one or more intensive and a control range of one or more extensive values.

27. The method according to claim 26, wherein the intensive value is I4, and the extensive value is E3.

28. The method according to any one of claims 24 to 27, wherein the test subject's cognitive processing is tested to detect a cognitive disorder selected from the group consisting of ADD, ADHD, dyslexia, dementia, schizophrenia, depression, learning disorders, post-traumatic stress disorder, sleep disorder, personality disorders, borderline personality disorders, or cognitive function impaired or enhanced by alcohol or drug ingestion.

29. A method for creating a control range for detecting cognitive processing of at least one test subject using a standardised task, the method comprising:

- measurement of time to complete the standardised task in members of a group of control subjects and measurement of temporal eyeblink occurrence and total eyeblink number N, for the control subjects; and
- sorting control subjects from lowest to longest time to complete the task and analysing each control subject having a similar task completion time with respect to their N value;
- creation of at least one control range of N values according to the time to complete the task,

wherein deviation from the control range indicates a test subject having altered cognitive processing relative to the control subjects having a similar task completion time.

30. The method according to claim 29, wherein the standardised task is a structured task, where the common phase is selected from:

- a first orientation phase, occurring at commencement of the task;
- a second or intermediate phase showing the test subject's task progress; and
- a common task completion period (CTCP) of the task.

31. The method according to claim 30, wherein the structured task is chosen to emphasise the test subject's mental processing during the orientation phase and/or intermediate phase of the task by incorporation of the orientation phase and/or intermediate phase into later phases of the task.

32. The method according to claim 30 or 31, wherein the common phase of the task is the common task completion period (CTCP) of the task.

33. The method according to claim 32, wherein the control subjects' times to complete the task are firstly sorted by adjusting blink patterns to align the CTCP of the task, prior to comparing of control subjects according to their N values during the CTCP of the task.

34. The method according to claim 29, wherein measurement of at least one of eyeblink characteristic of eyeblink power B is also performed, the eyeblink characteristic selected

from eyeblink duration and eyeblink amplitude, wherein the eyeblink characteristic occurs during performance of the standardised task.

35. The method according to any one of claims 29 to 34, which further includes interpretation of the control subjects' performances in the standardised task by linear regression using additional parameters for each control subject, the additional parameters including at least one intensive parameter calculated from the common phase of the task, and at least one extensive parameter calculated from blink patterns over the entire task, the intensive parameter being selected from the group comprising:

- percent of blinking time in last or common task completion period (CTCP), when blink density is above a baseline blink density (I1);
- mean cluster size (integral of height of density divided by number of peaks in last CTCP, representative of blinks clustered at each concentration release, whereby blink clusters are determined by measuring the area of each cluster peak above the local baseline) (I2);
- average baseline blink density in last CTCP (derived from the opening function by calculation of the incidence of minimum followed by a maximum in the relative density function within a threshold of 15 seconds or 10%-20% of the CTCP) (I3); and
- average blink rate for the task (calculated by total number of blinks over the task on total time taken for the entire task) (I4),

wherein I1 - I3 are derived using a smoothed blink density function F for each blink, and wherein the extensive parameter is selected from the group consisting of:

- total duration of task (E1 or T);
- total number of blinks (E2 or N);
- number of clusters during entire task time (peaks in blink density) (E3); and
- indirect measure of number of clusters/attempts at stages in task (E4), using a formula of attempts (A) = T^2/sum(gap^2);

further wherein the linear regression is used to establish a linear combination of at least one of I1 to I4 and at least one of E1 to E4 which best represents the structure of the blinking patterns in the control group, wherein variation in one or more intensive or

extensive parameters calculated for the control subjects provides data for the control range for the parameter derived by linear regression.

36. The method according to claim 35, wherein the smoothing function F is a normal Gaussian function.

37. The method according to claim 29, wherein structure of blinking patterns for the group is classified or ranked for similar times to complete the task and according to three ranges derived from N values, the ranges being assigned values between 1 and 3, wherein 1 represents highly structured or sparse blinking, and 3 represents struggling eyeblinking with an eyeblink pattern of low structure or dense blinking, and 2 represents an intermediate structure of eyeblinking.

38. The method according to any one of claims 29 to 37, wherein the control group consists of subjects with normal cognitive function.

39. The method according to any one of claims 29 to 37, wherein the control group consists of subjects with enhanced cognitive function.

40. A method according to any of claims 29 to 37, wherein the control group consists of subjects with compromised cognitive function.

41. A method according to claim 40, wherein the compromised cognitive function is associated with a disorder selected from the group consisting of ADD, ADHD, dyslexia, dementia, schizophrenia, depression, learning disorders, post-traumatic stress disorder, sleep disorder, personality disorders, borderline personality disorders, or cognitive function impaired or enhanced by alcohol or drug ingestion.

42. A method for detecting cognitive processing of at least one test subject using at least one standardised task, the method comprising:

- measurement of time to complete the standardised task and measurement of temporal eyeblink occurrence and total eyeblink number N, for the test subject; and
- comparison of the test subject's N value with a control range of N values corresponding the subject's time to complete the task,

wherein deviation from the control range indicates a test subject having altered cognitive processing relative to the control range.

43. The method according to claim 42, wherein the control range is calculated according to any one of the methods of claims 29 to 41.

44. The method according to claim 42, wherein the test subject's cognitive processing is compared with a control range selected from intensive and extensive values according to claim 35 or claim 36.

45. The method according to claim 44, wherein the intensive value is I4, and the extensive value is E3.

46. The method according to claim 45, wherein the intensive value is derived from I4 and E3.

47. The method according to claim 42, wherein a set of ranking values for each control subject, assigned according to the method of claim 37, is used to calculate an Objective Structure Index by linear regression from a set of intensive and extensive parameters calculated for each control subject, where the resulting linearised Objective Structure Index value is plotted as an intensive variable for each subject against an extensive variable for each control subject, wherein the extensive variable is T or N or some function of T or N, wherein the test subject may be compared with a joint distribution of the intensive and extensive variable for the control group.

48. The method according to any one of claims 42 to 47, wherein the test subject's cognitive processing is tested to detect a cognitive disorder selected from the group

consisting of ADD, ADHD, dyslexia, dementia, schizophrenia, depression, learning disorders, post-traumatic stress disorder, sleep disorder, personality disorders, borderline personality disorders, or cognitive function impaired or enhanced by alcohol or drug ingestion.

49. A device suitable for recording temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, according to the methods of any one of claims 1 to 48.

50. A device suitable for recording temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, and eyeblink characteristics of eyeblink duration and eyeblink amplitude, according to the methods of any one of the claims 1 to 48.

51. A device suitable for displaying temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, according to the methods of any one of claims 1 to 48.

52. A device suitable for displaying temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, and eyeblink characteristics of eyeblink duration and eyeblink amplitude, according to the methods of any one of claims 1 to 48.

53. Use of a device suitable for recording temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, for performing the methods of any one of claims 1 to 48.

54. Use of a device suitable for recording temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, and eyeblink characteristics of eyeblink duration and eyeblink amplitude, for performing the methods of any one of claims 1 to 48.

55. Use of a device suitable for displaying temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, for performing the methods of any one of claims 1 to 48.

56. Use of a device suitable for displaying temporal occurrence of eyeblinks during a time taken for a subject to complete a standardised task, and eyeblink characteristics of eyeblink duration and eyeblink amplitude, for performing the methods of any one of claims 1 to 48.

57. A method of computational analysis for analysing eyeblink data, in order to create a control range for cognitive processing and/or detect the cognitive processing of a test subject, according to the methods of any one of claims 1 to 48.

58. A method of assessing cognitive processing of a subject by analysis of eyeblink pattern in a standardised task.